Plant communities in a cultural landscape: incorporating aesthetics and historical land use in managing Iceberg Point (Lopez Island, WA)

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Iceberg Point (Lopez Island, WA) has been shaped by centuries of functional and aesthetic decisions by Coast Salish families and more recent residents, including prescribed burning and livestock grazing. Since the Bureau of Land Management assumed ownership in the 1980s, active management has ceased allowing a process of succession: Douglas fir and rose hedges are colonizing open forb meadows and grasslands. As the landscape mosaic changes visibly, questions arise about the extent to which the public owner should preserve and actively encourage culturally and aesthetically significant landscapes: can interfering with succession be justified on the basis of the diversity of cultural landscapes as well as plant species and communities?

Fine-scale maps of plant communities and soils are used to design a comprehensive approach to management that takes account of historical factors, aesthetic values, cultural resources (for Native Americans and non-Native residents), and biophysical processes, as well as the connection between terrestrial and marine ecosystems. A landscape mosaic of historical ecological changes and past human activities will be constructed from the data, and used to discuss alternative management goals and to plan a series of small-scale, but long-term experiments with different restoration methods.

The Questions
In restoration studies, questions can be separated into policy or aesthetic questions and those that can be addressed scientifically. The pertinent questions in this case are shown in Table 1.

Table 1: Questions in Conservation and Restoration

	Policy	Science
What is the desired landscape?	√	
What is the historical context?		√
What is the current ecological situation?		√
What processes are in play?		√
What is possible?		√
Which possibility is desired?	√	
Does the implementation produce the desired effect?		√

Context: community
Iceberg Point is located on the south end of Lopez Island, in the San Juan Archipelago. The island has a resident community of approximately 2,200 individuals (2000 census), is the ancestral home to Coast Salish families and is visited each year by many tourists and seasonal residents. It is in the context of these communities that the policy questions for restoration on Iceberg Point must be addressed. The preliminary answers to the question *what is the desired landscape*, from conversations with the landowner and with members of these communities: *native grassland*; *open space with wildflowers and butterflies*; and *natural* or *the way it used to be*.

The Historical Context: continuous stewardship
In order to understand the current landscape and to begin to understand what possibilities for restoration it offers we need to understand the historical management that created it.

Coast Salish
Coast Salish families camped and reef-netted at Iceberg Point for more than a millennium. They seasonally burned to encourage camas (*Camassia spp.*), bracken fern (*Pteridium aqulinum)* and *Fritillaria spp.* (chocolate lily and rice-root) production and to prevent forest and shrub encroachment. Fire scars indicate a maximum fire-free interval of 11 years at Iceberg Point (Spurbeck & Kennum 2003), and soil samples collected in the course of this study show evidence of frequent fires. The frequent fires maintained the meadow areas as well as a parkland forest. An open

forest would have facilitated berry and game harvests and may have been maintained intentionally for that purpose. Fall burning to promote root crops may have been accompanied by spring hoeing and weeding; and it is possible that desirable crops (such as camas) were actively transplanted into the area. This management regime was characterized by frequent light fires, high soil disturbance, moderate herbivory (primarily deer, controlled by hunting) and high POM and nutrients. The meadow areas were likely primarily forbs under Coast Salish management.

Coast Guard

Around 1890 Coast Guard lighthouse keepers introduced Eurasian livestock, particularly sheep; and sheep spread Eurasian forage grasses (e.g. *Bromus hordaceaus, Dactylis glomerata* and *Festuca eliator*). The island was settled around this time and the harvesting of trees for lumber and fuel may have increased, particularly as adjacent lands were cleared and developed. Early observers noted the devastation wrought by forest fires set by settlers to clear land for their houses and farms (*e.g.* Kennerly in 1860); and it is reasonable to infer that fire intensity increased briefly in the 1870s-1890s, followed by fire suppression, unmanaged regrowth and extensive logging. However, some very old trees have survived. In the old meadows, during this time, herbivory (in the form of sheep grazing) intensified and the fire-free interval increased. The meadow areas shifted to primarily forage grasses under Coast Guard management.

Bureau of Land Management

Since acquiring the property in the 1980s, BLM has adopted a hands off policy and minimized intervention in the recovery of the landscape from the livestock, logging and fires. Iceberg Point is designated by the BLM as an Area of Critical Environmental Concern (ACEC), mandating that use and management focus and its environmental value. The land has been opened to public access, and visits appear to have increased since the 1980s. Deer have replaced sheep, reducing the level of herbivory (though there are few controls on the deer population). This decreased herbivory along with dense young Douglas firs and the absence of fires has increased fuel loads. Areas of native grasses, forbs and cryptogams are restricted to marginal areas with little or salty soil (see Figure 2). Meadows are dominated by Eurasian forage grasses and the area is undergoing rapid oligarchic succession. Eurasian grasses are replacing native grasses and forbs, tall Eurasian grasses are replacing shorter Eurasian grasses, shrubs are replacing tall grasses and Douglas firs are replacing the shrubs (Figure 1, see also Figure 3). These threatened meadows are the area's most significant contribution to native Puget Sound habitat (Dougherty 2004). The meadow areas are shifting to shrub cover under BLM management.

The Current Ecological Situation: rapid change

The current ecological situation of plant communities is a product of this past management, and of the succession pattern that it produces. The plant communities on Iceberg Point can be separated into restricted and expanding communities. The restricted plant communities are present in marginal areas and appear restricted to these areas. The expanding plant communities are present where the soil is deeper, wetter and less salty and in areas more protected from weathering. They are expanding in a succession pattern into restricted communities or into other expanding communities. (Fieldwork conducted in December 2004. Observations of wildflowers from spring and summer 1985-2005. All species marked with an asterisk are non-native.)

Restricted plant communities

Rocky balds

The areas on the balds that are not covered in *Cladina* are a mixture of lichens, bryophytes and colonizing vascular plants. Areas with no soil are colonized by lichens only, which give way to mosses and *Cladina* as soil accumulates and eventually are colonized by *Sedum lanceolatum* (narrow-leaved stonecrop), *Sedum spathulifolium* (broad-leaved stonecrop), **Hypochoeris radicata* (hairy-cats-ear), **Rumex acetosella* (sheep sorrel), **Holcus lanatus* (velvet grass) and various grasses including native *Festuca spp.* Mosses and lichens persist in these areas where forbs and grasses have become established. *Polemonium pulcherrimum* (showy polemonium) is also found on a few of the balds on Iceberg Point. This conspicuous wildflower is rare on Lopez.

Wildflowers

The edges of these balds support a variety of other wildflowers, including the conspicuous flowers that are one of Iceberg Point's main attractions. Conspicuous wildflowers include *Lomatium urticulatum* (spring

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gold), *Allium acuminatum* (Hookers onion), *Allium cernuum* (nodding onion), *Brodiaea coronaria* (harvest brodiaea), *Cammassia leitchlinii* (great camas), *Cammassia quamash* (blue camas), *Fritillaria lanceolata* (chocolate lily), *Orobanche uniflora* (naked broomrape), *Dodecatheon pulchellum* (few-flowered shooting star), *Olsynium douglasii* (grass-widows) and *Delphinium menziesii* (Menzies larkspur).

Cladina meadows

These meadows are primarily on rocky balds, and consist almost entirely of *Cladina spp*. with some bryophytes and vascular plants growing among them. The primary vascular plants in these meadows are the naturalized **Hypochoeris radicata* (hairy-cats-ear), **Rumex acetosella* (sheep sorrel) and **Holcus lanatus* (velvet grass). The native stonecrops *Sedum lanceolatum* (narrow-leaved stonecrop) and *Sedum spathulifolium* (broad-leaved stonecrop) are also present in *Cladina* meadows. These meadows are particularly sensitive to human traffic.

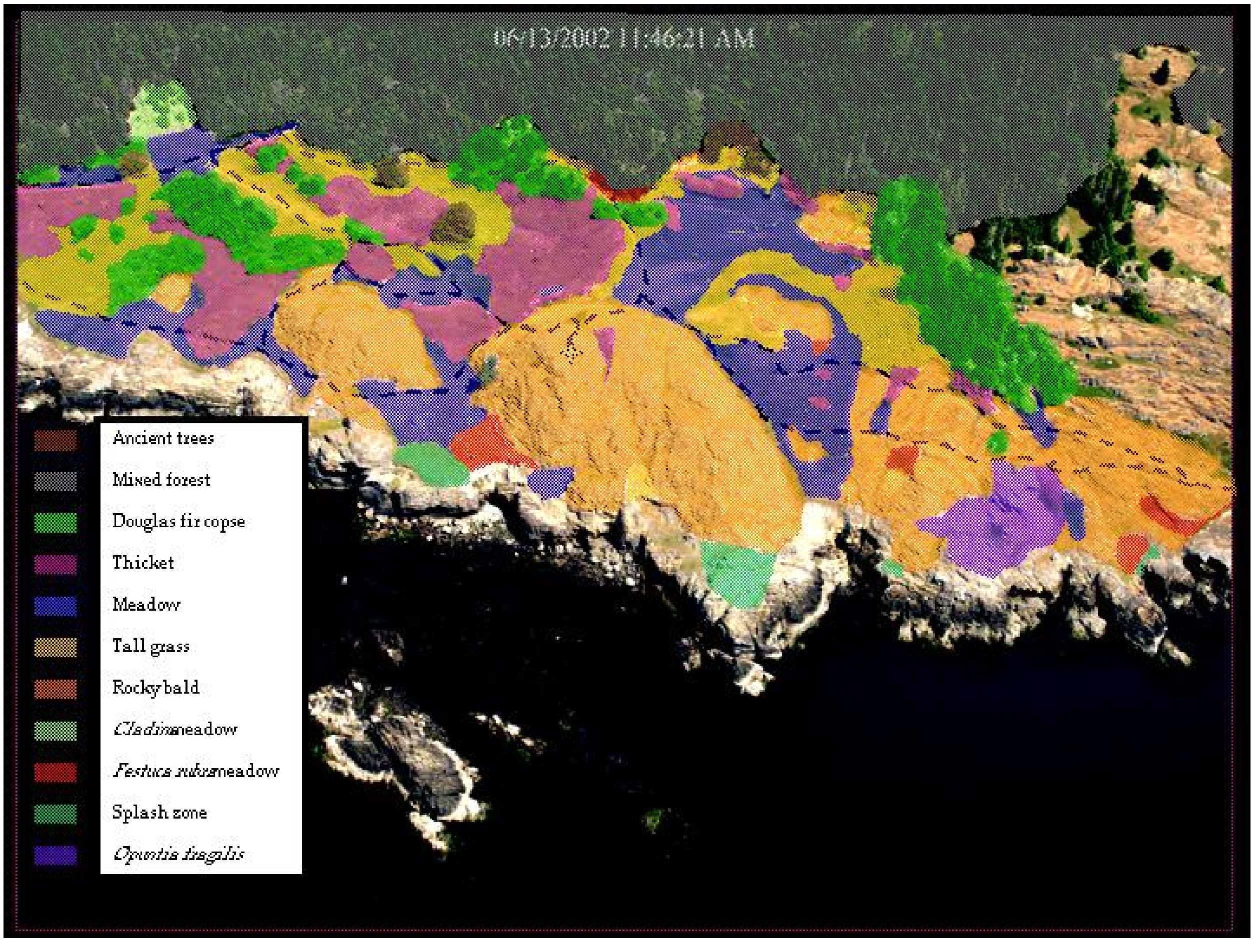

Figure 1: Expanding and Restricted Plant Communities at Iceberg Point
(figure from Barsh and Murphy 2005)

Festuca rubra herbaceous vegetation

There are a few areas dominated by *Festuca rubra* (red fescue). The forbs in these areas are almost exclusively native, including *Armeria maritima* (sea thrift), *Lepidium spp.* (peppergrass), *Spurgularia spp.* (sandspurry) and *Grindelia integrifolia* (Puget Sound gumweed). The fescue meadows are found primarily along the cliffs just beyond the splash zone communities. Fescue is also found in areas of deeper soil on balds and interspersed with other grasses in forb-grass meadows.

Distichlis spicata-Armeria maritima herbaceous vegetation (splash zones)

At the edges of the lower cliffs there are areas of soil with a very high chloride content that are populated by plant species typically found in salt marshes. The dominant grass is *Distichlis spicata* (seashore saltgrass) accompanied by some *Festuca rubra* (red fescue). Forbs are primarily *Armeria maritima* (sea thrift), *Plantago maritimum* (sea plantain), *Lepidium spp.* (peppergrass) and *Grindelia integrifolia* (Puget Sound gumweed). In some areas where there is very little soil, *Plantago maritimum* or *Armeria maritima* are the only species present.

Ancient trees

Outside of the forest there are some individual trees around 200-300 years old. Most are *Pseudotsuga mensziesii* (Douglas fir), though there are also ancient *Picea sitchensis* (Sitka spruce). These trees are growing in deep meadow soils and their growth habit suggest that they grew up as isolated individuals. Around these trees grow **Festuca eliator* (tall fescue), *Rosa nutkana* (Nootka rose), *Symphoricarpos albus* (snowberry) and pioneering *Pseudotsuga menziesii* and *Picea sitchensis*. Other weedy species present in these areas include **Dactylus glomerata* (orchard grass), **Bromus hordeaceus* (soft brome), **Rumex acetosella* (sheep sorrel) and **Plantago lanceolata* (narrow-leaved plantain).

Expanding plant communities:

Psudotsuga menziesii/ Symphoricarpos albus-Holodiscus discolor forest (Mixed forest)

Most of the forest on Iceberg Point is young *Pseudotsuga menziesii* (Douglas fir), *Symphoricarpos albus* (snowberry), *Holodiscus discolor* (oceanspray) forest. *Abies grandis* (grand fir), *Alnus rubra* (red alder) and *Pinus contorta* (shore pine) are also present. There are scattered older trees up to around 200 years old. The understory shrubs also include *Rosa gymnocarpa* (wood rose), *Linnea borealis* (twinflower), *Rubus ursinius* (trailing blackberry), *Rubus spectabilis* (salmonberry) and *Lonicera spp.* (honeysuckle). Forbs present include *Sanicula crassicaulis* (Pacific sanicle), *Satureja douglasii* (yerba buena), *Trientalis borealis* (broadleaf starflower) and *Ohsmorhiza chilensis* (mountain sweet-cicely). The understory also supports a diversity of bryophytes, including *Hylocomium splendens* (stair-step moss), and fungi, including *Dentinum repandum* (hedgehog mushroom), *Russula spp.* (russula), *Suillus spp.* (slippery jack) and *Tremella mesenterica* (witches' butter).

> *Pinus contorta-Psuedotsuga menziesii*/*Gaultheria shallon* forest
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> On the west side of Iceberg Point, upland from Reefnet Cove, the young forest is dominated by *Pinus contorta* (shore pine) with an understory dominated by *Gaultheria shallon* (salal). *Psuedotsuga menziesii* (Douglas fir), *Abies grandis* (grand fir), *Picea sitchensis* (Sitka spruce) and *Arbutus menziesii* are also present. There are a few older (to 200 years) trees present (*Psuedotsuga menziesii* and *Picea sitchensis*). The understory also includes *Maianthemum dilatatum* (wild lily-of-the-valley).

Pseudotsuga menziesii copses

These are monostands of young *Psudotsuga menziesii* (Douglas fir). The understory is virtually nonexistent; only fungi, particularly *Russula rosacea* (rosy russula), grow in the dark under their dense growth. At the edges of these copses *Rosa nutkana* (Nootka rose), *Symphoricarpos albus* (snowberry), **Festuca eliator* (tall fescue) are dominant. They are accompanied by *Satureja douglasii* (yerba buena), *Rubus ursinius* (trailing blackberry) and small forbs such as *Fragaria vesca* (wild strawberry) and **Plantago lanceolata* (narrow-leaved plantain). These copses are present in areas of deeper meadow soil, particularly those sheltered from the wind or with water running into them.

Rosa nutkana-Symphoricarpos albus shrub thickets

Rosa nutkana and *Symphoricarpos albus* are co-dominant in most of these thickets. There are a few which are almost entirely one or the other, but most are mixed. There is little understory in these thickets; though bryophytes and a few small forbs such as *Cardamine sp.* (cress), **Plantago lanceolata* (narrow-leaved plantain), *Galium sp.* (bedstraw) and *Claytonia perfoliata* (miners lettuce). At the edges of the thickets **Festuca eliator* (tall fescue) and **Dactylus glomerata* (orchard grass) are abundant. *Satureja douglasii* (yerba buena), *Rubus ursinius* (trailing blackberry), *Vicia spp.* (vetch) and **Holcus lanatus* (velvet grass) are also present at the thicket edges.

Festuca eliator-*Dactylus glomerata* herbaceous vegetation (tall grass meadows)

These tall European grasses form large areas of dense mounds of vegetation, which allow for few other species to grow and make human passage difficult. Much of the area also has patches of very short (under 12") *Symphoricarpos albus* (snowberry). *Rubus ursinius* (trailing blackberry) also grows in and around the grass mounds.

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Pteridium aqulinum (bracken fern) is a component of this community and is particularly abundant on the slope of the eastern part of the property. This plant community is frequent on the edges of thickets and copses.

Bromus hordeaceus-Plantago lanceolata herbaceous vegetation (meadows)
These meadows can be separated into two categories depending on which of the co-dominants is more numerous. In the grass meadows **Bromus hordeaceus* (soft brome) is dominant and more grasses are present. In the grass-forb meadows **Plantago lanceolata* (narrow-leaved plantain) is dominant and forbs are more numerous. In both communities there are mixtures of native and naturalized grasses and forbs. Other grasses present include **Festuca eliator* (tall fescue), **Dactylus glomerata* (orchard grass), *Festuca rubra* (red fescue), **Agrostis scabra* (tickle grass), **Holcus lanatus* (velvet grass) and **Aira praecox* (hairgrass). Forbs present include *Lomatium urticulatum* (spring gold), **Geranium molle* (dove-foot geranium), *Galium spp.* (bedstraw), *Cerastium arvense* (field chickweed), **Hypochoeris radicata* (hairy-cats-ear), *Eriophyllum lanatum* (common woolly sunflower), *Vicia spp.* (vetch), **Silene sp*. (catchfly), *Viola adunca* (western long-spurred violet) and *Achillea millefolium* (yarrow). There are also patches of bryophytes and lichens in these meadows. *Cladina spp.* (reindeer lichen) and *Cladonia spp.* are particularly abundant. Patches of exposed rock in the meadow communities support a diversity of bryophytes and lichens. Around paths *Lupinus microcarpus* (chick lupine) and *Lomatium urticulatum* (spring gold) are also abundant. The meadows also include *Ranunculus californicus* (California buttercup) which is rare in Washington, though abundant in the San Juan Islands, and *Ranunculus occidentalis* (western buttercup) as well a hybrids of the two.

Rare native species:

Opuntia fragilis (prickly pear cactus)
This native cactus is rare in western Washington and occurs in isolated patches in the San Juan Islands. The patches of cacti on Iceberg Point are only on the eastern slope of the balds around the monument. In that area the cacti are numerous and grow on the rocks, in meadows with *Festuca rubra* (red fescue) and in mixed grass meadows. It is easily dislodged and sensitive to human traffic.

Oxytropis campestris var. *gracilis*
This species is listed as sensitive in Washington State and is has only three recent recorded occurrences in the state. It was reported at Iceberg Point in 1992 (WNHP, 2003).

Ranunculus californicus
This species is listed as threatened in Washington State. In Washington it is most common in the San Juan Islands and is abundant on Iceberg Point, where it hybridizes with *R. occidentalis*.

Polemonium pulcherrimum (showy polemonium)
This conspicuous wildflower is rare in the San Juans and only present in a few locations on Lopez.

Ecological Processes:

Our field observations suggest the soil depth is important in determining the succession patterns and plant community distribution on Iceberg Point (Figure 2). Soil depth and mineral content vary considerably in the areas surveyed. Moss-lichen communities on rocky balds have young, acidic soils with relatively high concentrations of aluminum and iron. Soils sampled under ancient trees were relatively acidic, suggesting long established forest soils. However, samples from the mixed woods and Douglas fir copses lacked the acidity or ammonia concentration typical of forest soils; instead they were often very deep, with thick black greasy A-layers more typical of longstanding open meadows or grasslands (Barsh and Murphy 2005). Structurally typical forest soils were found more than 75 meters inside the edge of the mixed forest (see also Dougherty 2004). The deep black meadow soils suggest, with their high organic content suggest a history that may have included ancient gardening using fire and hoeing to promote camas and other root crops.

The deeper soils are more readily colonized by tall European grasses, which in turn serve as shelter for the establishment of shrubs, and eventually Douglas fir. Areas of thin soil and subject to heavy weathering continue to support smaller native grasses (*Festuca spp.* and *Distichlis spicata)*. The importance of soil depth also suggests that the role of bryophytes as soil builders merits further attention. Soil accumulates under moss and lichen blankets, eventually creating habitat for grasses and forbs.

Succession trajectories (Figure 3) are also suggested by the patterns of plant distribution: establishing snowberry and Nootka rose are often found growing in and under tall grasses and Douglas fir copses are surrounded by thickets (often with an area of dead rose and snowberry in the shade of the growing trees) and the thickets in turn by a fringe of tall grasses (see Figure 1). Longer-term observations are required to verify these hypothesized trajectories, which have important practical implications for meadow restoration.

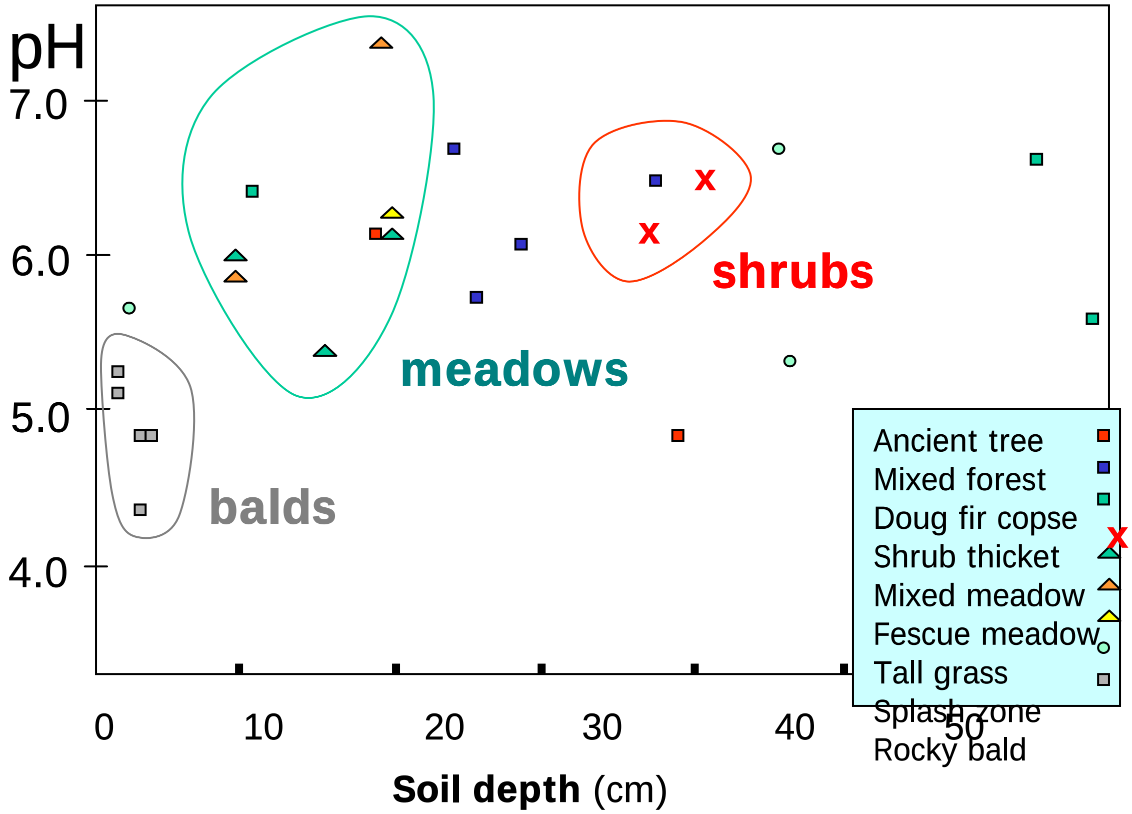

Figure 2: Soil Depth and pH for Iceberg Point Plant Communities
Expanding plant communities tend to be present on deeper soils (figure from Barsh and Murphy 2005)

Mosses and lichens build and collect soil on top of rocks and rocky areas. Meadows accumulate organic soils as plant matter decays. Snowberry and rose thickets and forests accumulate soil relatively slowly. The herbaceous component of a grass meadow is has relatively little influence on the rate of soil accumulation but taller grasses facilitate the growth of shrubs. When enough soil is accumulated, the meadows that contributed to its accumulation are colonized by shrubs and copses, which accumulate at a much reduced rate. This places a limit on the depth of soil and the success of native grass meadows.

The hydrology of Iceberg Point also influences the distribution of plant communities. Iceberg Point is divided by many shallow troughs that channel surface water and in turn accumulate moist soil. Shrubs and Douglas firs colonize these pockets of deeper and wetter soil; expanding plant communities often follow the natural drainage pattern (see Figure 1).

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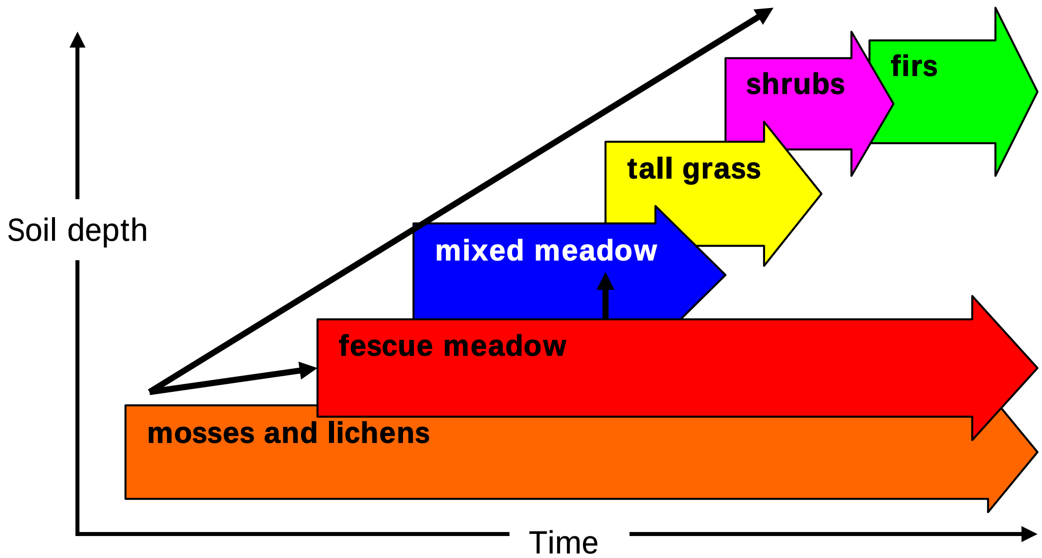

Figure 3: Hypothesized Succession Trajectories for Iceberg Point Plant Communities.

Iceberg Point has a southwest aspect and a southeast aspect divided by a ridge that runs from the geodetic survey monument (marked on Figure 1 with a white star) northwest through the property. These two aspects support slightly different plant communities. The southwest aspect (west of the monument) is subject to harsher winds and storms, but the slope is more mild than the southeast aspect. The ratio of the more salt tolerant rose to snowberry in thickets is higher on southwest aspect. The southeast side (east of the monument), though more sheltered, also more has a steep slope, with more bedrock exposed as balds balds and supports cacti. However where the southeast side is more level plants are not restricted by exposure as they are to the southwest.

Herbivory and animal activity impact the plant communities on Iceberg Point. Deer and voles are both present on the property and plants and soils show evidence of their activity. These animals act to limit certain plant species and to disperse of seed and propagules. By digging animals break up soil and create gaps in meadows and areas of moss and lichen. These gaps can promote colonization by other plant species.

As in the past, human activity, stewardship and management continue to impact succession dynamics on Iceberg Point. Trails create disturbance and areas of short vegetation. These trails support a different assemblage of plants than areas with taller grass and shrub cover. Trails and trail edges encourage trample resistant, rosette forming forbs and short mosses. The densest areas of *Lupinus spp.* and *Lomatium urticulatum* are along trails; these trails also support an abundance of **Hypochoeris radicata* and **Plantago lanceolata*. Foot traffic selects against more delicate or brittle plants and cryptogams, particularly *Cladina*. Humans also disperse seeds and spread both native and non-native grasses and forbs.

This history of management and succession continues to affect the current succession patterns on Iceberg Point. The introduction of non-native grasses has changed the way that the landscape responds to disturbance. These grasses facilitate the establishment of shrubs and trees, while the native grasses and forbs offer fewer footholds for woody succession. Management decisions must be based upon an understanding of the landscape history; the way a landscape changes in response to manipulation is influenced by its history and the results of management can be interpreted in the context of this history.

What is possible: research design

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Our fieldwork and the historical data available for Iceberg Point suggest that it is an area in which both *natural* and *the way it used to be* are very hard to define. If natural is defined as pre-cultural then the landscape at Iceberg Point may not have been "natural" since around the end of the Vashon glaciation considering the archeological evidence that the San Juan Islands were occupied then (the style of artifacts found on the south end of Lopez are consistent with occupation since 6,000-9,000 years ago). And the idea of restoring a landscape to *the way it used to be* in the context of a changing environment and changing management regimes begs the question: *when?* The matter of which restoration outcome is desired is one that cannot be answered scientifically; the role of our experiment is to determine how the landscape responds to different management techniques and what landscapes are possible.

In order to gain the most understanding of the effects of differing management techniques with the least negative impact on both the ecology and the aesthetics of the landscape we are proposing a broken mosaic of small plots representing the different plant communities and treatments (Table 2).

Table 2: Plot Treatments for Iceberg Point Restoration Study
Plots in wooded areas are 8X8m; plots in other areas are 3X3m. Each plot is paired with a control plot and each pair is replicated (for a total of four plots per community and treatment).

Ancient Trees	**Remove ladder fuels and understory shrubs**
Mixed Age Forest	**Remove ladder fuels and youngest firs**
Douglas Fir Copses	**Remove firs and understory shrubs** **Hand-clear firs and understory, then fall burn**
Shrub Thickets	**Hand-cut and remove shrubs** **Hand-cut shrubs then fall**
Tall Grass Meadows	**Spring mow** **Spring mow, then fall burn**
Mixed Meadows	**Fall burn** **Transplant native species**
Fescue Meadows	**Monitor change only**
Rocky Balds	**Monitor change only**
Splash Zones	**Monitor change only**

Because of the delicate nature of the restricted plant communities no manipulations are proposed for plots in these areas; the plots are set up to monitor changes and human traffic in a controlled fashion. The control plots for these communities are located in non-trail areas, while the "treatment plots" are located to include trails.

Indicators of change

In order to understand the effects of our manipulations we will be monitoring key indicators of change for each plot. These indicators have been selected to encompass a wide measure of changes and to be readily measurable and sensitive. They are also indicators that relate directly to the desired landscapes: *native grassland* and *open space with wildflowers and butterflies* . These indicators are:

Changes in soil chemistry
Changes in the structure of plant communities
Changes in the diversity of native species found in each plot
Communities' landscape perception

To measure changes in soil chemistry an annual sample of the A-layer from each plot will be collected in late winter (after treatments have been completed) and sampled for pH and parts per million of nitrate, phosphate, magnesium and iron. This will capture the changes in soil chemistry from burning and indicate whether these nutrients will act as limiting factors in the establishment of native plant species.

To measure the changes in the structure of plant communities we will take photos of each plot from a fixed point in the spring and use planimetry to measure the area coverage by dominant tree, shrub, grass, forb and cryptogam species.

To capture the changes in the diversity of native species three measures will be used. Spring and summer field observations will be used to determine the number of native species represented in each plot. Soil will be collected from the A- and O-layers and germinated to determine the number and proportion of plant species in the seed bank. Butterflies will be trapped for four days in the spring to determine the number of butterfly species with native plant primary hosts that are present. These three measures capture the plant species richness both within the plots and, in the case of the butterflies, across the landscape. The seed bank studies will also determine if there are species present in the seed bank that are not germinating in response to the treatments.

Because we are dealing with a cultural landscape and one that is important to various communities aesthetically, a measure of the success of any treatment will also be in its perception by the communities. This information will be gleaned from feedback by community members who participate in the restoration work, community members who observe the landscape after treatment and from responses at community meetings and presentations.

This diversity of indicators will allow us to adapt our management scheme to encourage the type of landscape possible and desired by the landowner and interested communities.

In conclusion:

The landscape of Iceberg Point can be seen as an artifact not only of prehistoric land management, but of all management activities carried out within the landscape. The diverse landscape is the product of intentional manipulations for centuries. To speak of such a landscape as "natural" is confusing. In designing our experiment we have attempted not only to learn from past management decisions, but to include all phases of management in recognition that the landscape is irrevocably changed during each management regime. The experiment is designed to allow for adaptive management and monitoring so that the desired possible landscape can be achieved. Restoration in a cultural landscape, regardless of the desired landscape, requires an understanding of each culture that has managed it; their decisions and actions have changed how it will react to future manipulation.

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